

# Operating Instructions

Radar sensor for continuous level measurement of liquids

## CNCR-190

Two-wire 4–20 mA/HART



***BINMASTER.***

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# 1 About this document



**Information, note, tip:** This symbol indicates helpful additional information and tips.



**Note:** This symbol indicates notes to prevent failures, malfunctions, damage to devices or facility.



**Caution:** Non-observance may result in personal injury.



**Warning:** Non-observance may result in serious or fatal personal injury.



**Danger:** Non-observance of the information marked with this symbol results in serious or fatal personal injury.



## **Ex applications**

This symbol indicates special instructions for Ex applications.



## **List**

The dot set in front indicates a list with no implied sequence.



## **Sequence of actions**

Numbers set in front indicate successive steps in a procedure.



## **Battery disposal**

This symbol indicates special information about the disposal of batteries and accumulators.

# 2 For your safety

## 2.1 Authorized personnel

All operations described in this documentation must be carried out only by trained, qualified personnel authorized by the plant operator. Required personal protective equipment must always be worn when working on or with the device.

## 2.2 Appropriate use

CNCR-190 is a sensor for continuous level measurement.

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions.

## 2.3 Warning about incorrect use

Inappropriate or incorrect use of this product can result in application specific hazards, e.g. vessel overflow by incorrect mounting or adjustment. Damage to property and persons or environmental contamination can result.

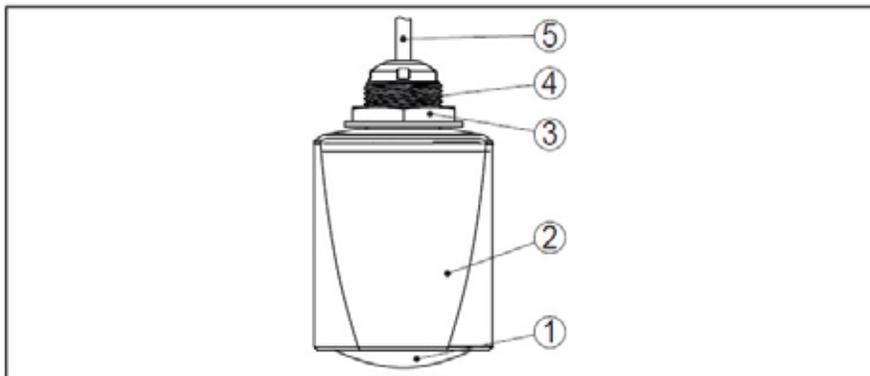


### Safety instructions for Ex areas

Take note of the Ex specific safety instructions for Ex applications. These instructions are attached as documents to each instrument with Ex approval and are part of the operating instructions.

## 3 Product Description

### 3.1 Configuration



**Constituent parts**

Fig. 1: Components of CNCR-190

1. Radar antenna
2. Electronics housing
3. Mounting thread
4. Locking nut
5. Connection cable

### 3.2 Principle of operation

CNCR-190 is a radar sensor for continuous level measurement. It is suitable for liquids and solids in practically all industries.

The instrument emits a continuous, frequency-modulated radar signal from its antenna. The emitted signal is reflected by the material and received by the antenna as an echo with a modified frequency. The frequency change is proportional to the distance to the material.

### 3.3 Adjustment

Devices with integrated Bluetooth module can be adjusted wirelessly via software adjustment tools:

- Smartphone/tablet (iOS or Android operating system)
- PC/notebook with Bluetooth USB adapter (Windows operating system)

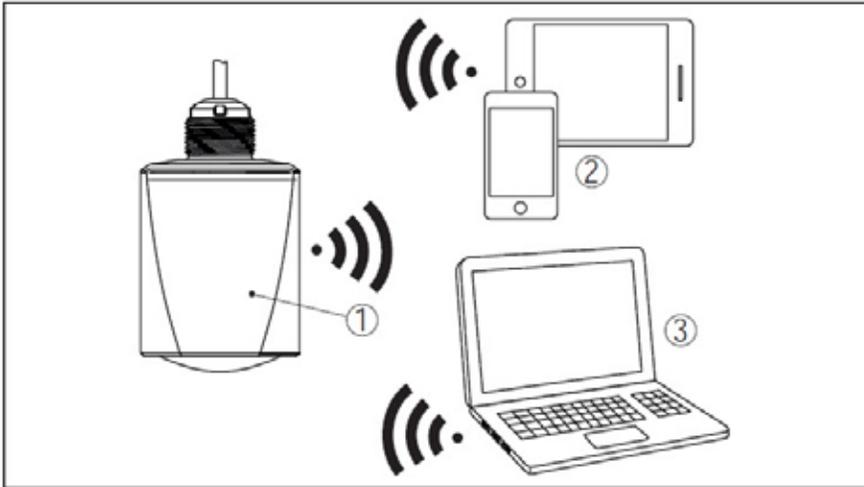


Fig. 2: Wireless connection to standard operating devices with integrated Bluetooth LE

1. Sensor
2. Smartphone/Tablet
3. PC/Notebook

Devices with signal output 4–20 mA/HART can also be operated via a signal cable. This is done via an interface adapter and a PC/notebook using DTM/PACTware.

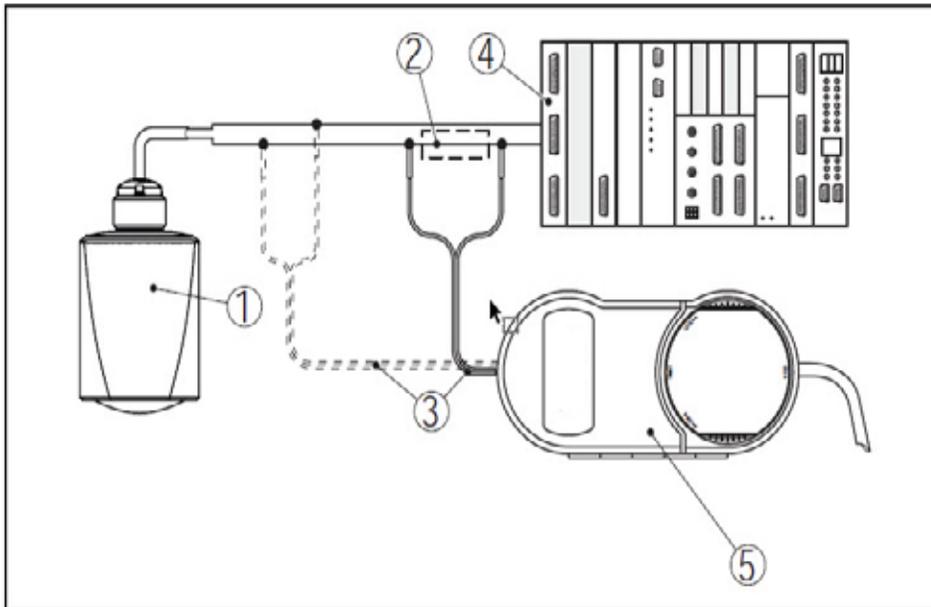


Fig. 3: Connecting the PC to the signal cable

1. Sensor
2. HART resistance 250  $\Omega$  (optional depending on evaluation)
3. Connection cable with 2 mm pins and terminals
4. Voltage supply
5. Interface adapter

## 4 Mounting

### 4.1 General instructions

The instrument is suitable for standard and extended ambient conditions according to DIN/EN/IEC/ANSI/ISA/UL/CSA 61010-1. It can be used indoors as well as outdoors.

### 4.2 Mounting

For the wall mounting, a mounting bracket with opening for thread G1 is recommended. The sensor is mounted in the bracket using the supplied G1 plastic nut. Take note of Figure 4 for the recommended distance to the wall.

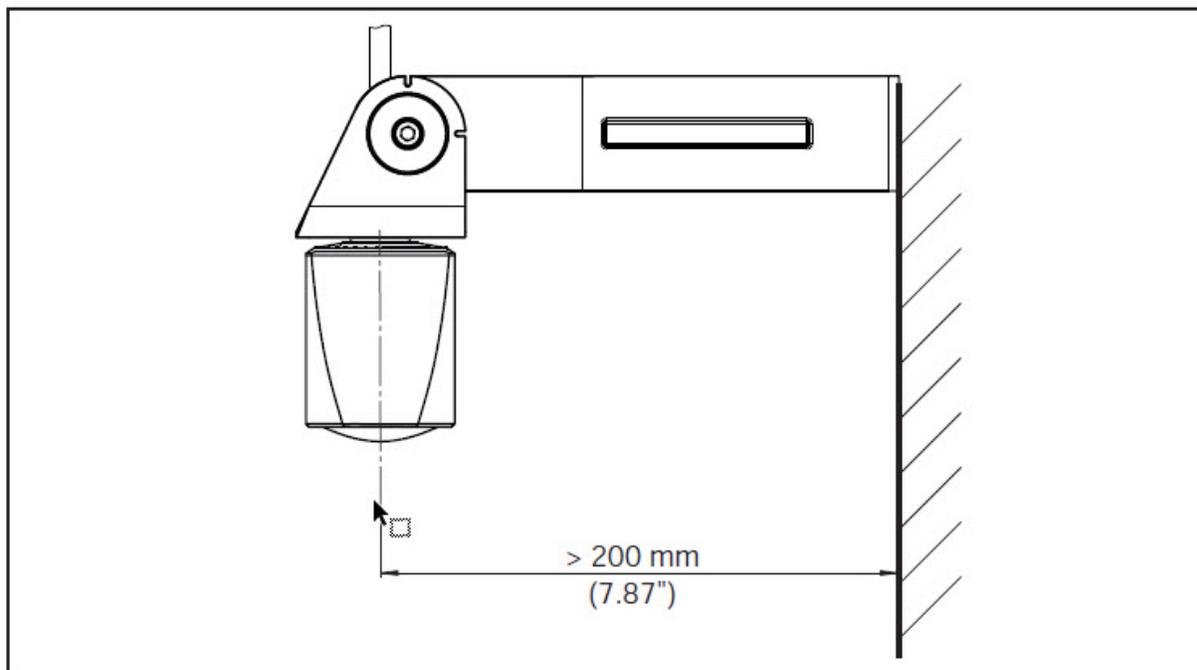


Fig. 4: Mounting via a mounting bracket

### 4.3 Mounting instructions

The radar emits pulses of electromagnetic waves which are polarized. By adjusting rotation of the instrument the polarization can be changed to reduce false echoes.

The narrow portion of the radar signal is in the middle of the printed label on the instrument. This should be pointed towards the center of the vessel or any obstacle that may cause any unwanted reflection to minimize false echoes, for example the sidewall or vessel structure.

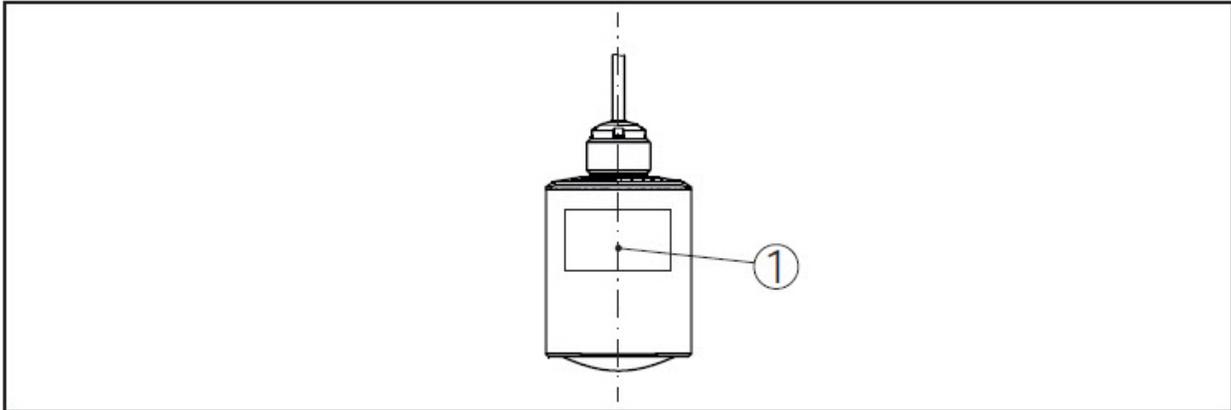


Fig. 5: Polarization position  
1. Middle of the printed label

When mounting the sensor, *distance it at least 200 mm (7.874 in)* from the vessel wall. If the sensor is installed in the center of a round vessel top, multiple echoes can arise. However, these can be suppressed by a false signal suppression (see chapter “Setup”).

If you cannot maintain this distance, you should carry out a false signal suppression during initial setup. This applies particularly if buildup on the vessel wall is expected. If this is the case, we recommend repeating the false signal suppression later with the additional buildup.

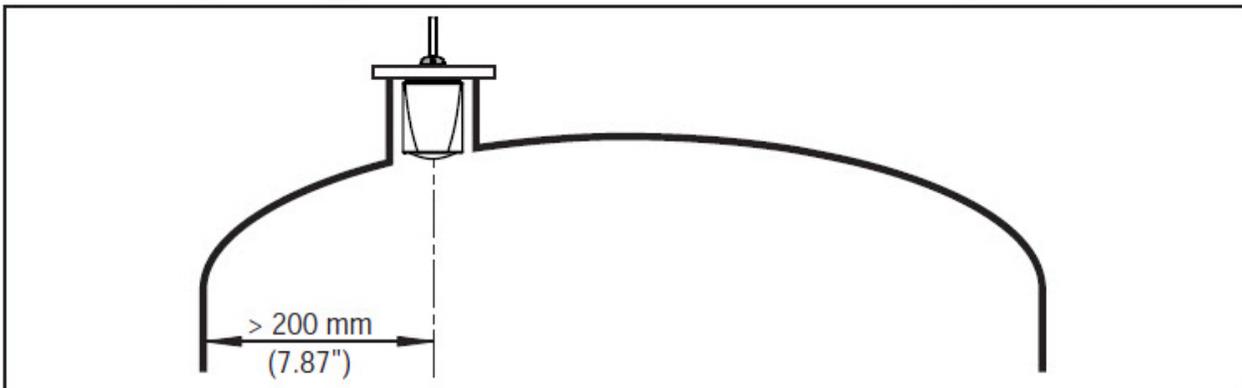


Fig. 6: Mounting of the radar sensor on round vessel tops

In vessels with cone bottoms, the sensor can be mounted in the center of the vessel to measure material down to the outlet.

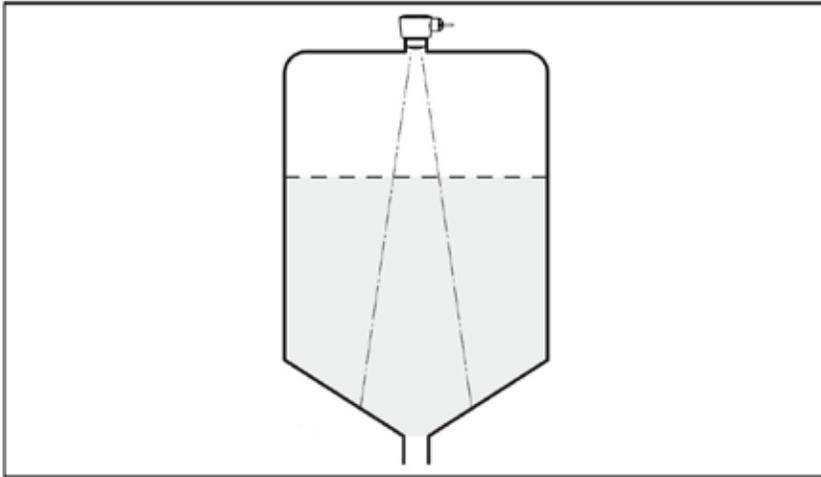


Fig. 7: Mounting the radar sensor with conical bottom

The antenna edge of the device is the beginning of the measuring range and at the same time the reference plane for the min./max.adjustment, see following diagram:

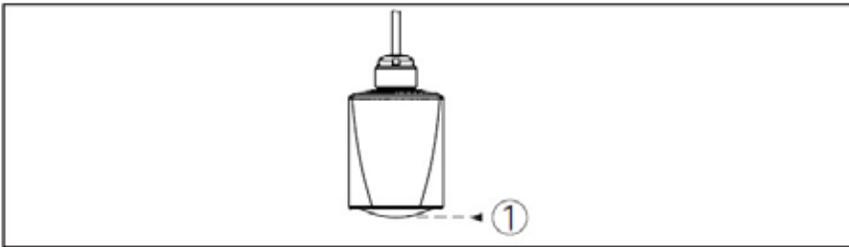


Fig. 8: Reference plane

1. Reference plane

Do not mount the instruments in or above the fill stream. Make sure that it is pointed towards the material surface, not the fill stream.

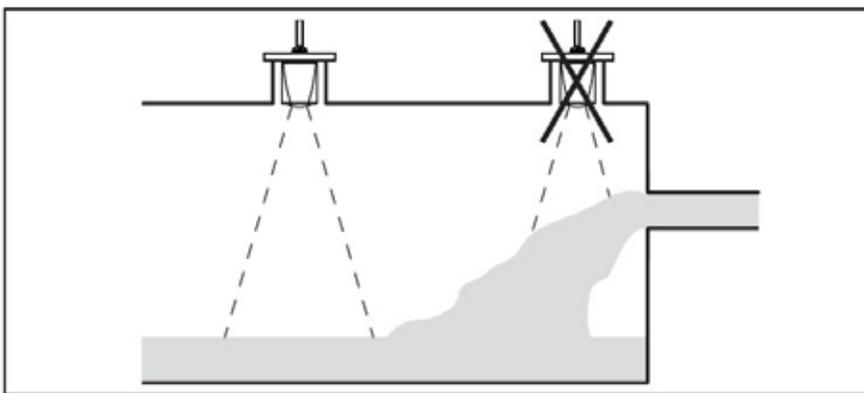


Fig. 9: Mounting of the radar sensor away from fill stream.

For socket or stand pipe mount, the pipe should be as short as possible and its bottom end rounded to reduce false reflections from the end of the pipe.

The antenna edge should protrude at least 5 mm (0.2 in) out of the socket or stand pipe.

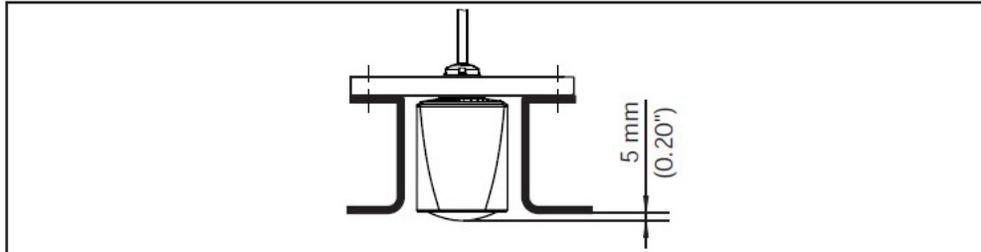


Fig. 10: Recommended socket mounting of CNCR-190

If the reflective properties of the material are good, you can mount the CNCR-190 on sockets or stand pipe longer than the antenna. The pipe end should be smooth, burr-free, and the end rounded.



**Note:**

When mounting on longer sockets or stand pipes, we recommend carrying out a false signal suppression after install (see chapter “Parameter adjustment”).

Recommended values for socket or stand pipe lengths and heights are in the following table. The values come from typical applications.

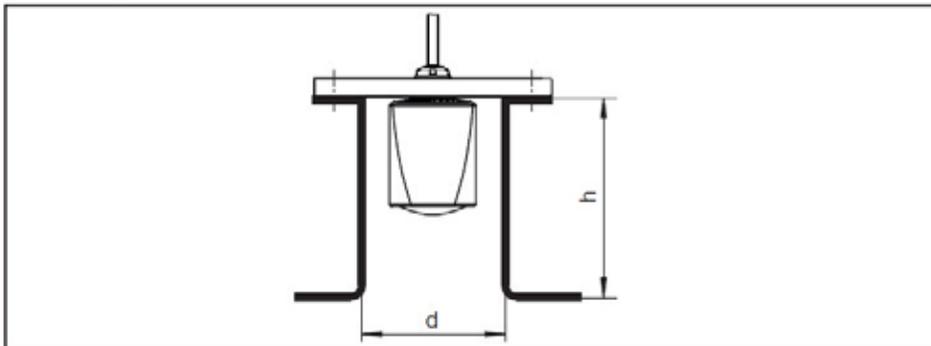


Fig. 11: Socket mounting with deviating socket dimensions

Socket diameter d		Socket length h	
80 mm	3"	≤ 300 mm	≤ 11.8 in
100 mm	4"	≤ 400 mm	≤ 15.8 in
150 mm	6"	≤ 600 mm	≤ 23.6 in

The sensor should be mounted in a location where the radar signal is not interfered with by structure, such as ladders, braces or fill stream.

Make sure when planning the installation there is a clear, unobstructed view to the material to be measured. After installation a false signal suppression should be carried out to minimize any reflections from the mount or nearby structure.

## 5 Connecting to power supply

### 5.1 Preparing the connection

Always keep in mind the following safety instructions:

- Carry out electrical connection by trained, qualified personnel authorized by the plant operator
- If overvoltage surges are expected, overvoltage arresters should be installed



**Warning:**

Only connect or disconnect in de-energized state.

**Note:**



Power the instrument via an energy-limited circuit (power max. 100 W) according to IEC 61010-1, e.g.

- Class 2 power supply unit according to UL1310)
- SELV power supply unit (safety extra-low voltage) with suitable internal or external limitation of the output current

The device is supplied with a fixed connected cable. If an extension is required, a standard two-wire cable can be used.

If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, shielded cable should be used.

Shielded cable generally necessary in HART multidrop mode.

We recommend to connect the cable screening to ground potential at one end on the supply side when using shielded cable.

### 5.2 Wiring plan

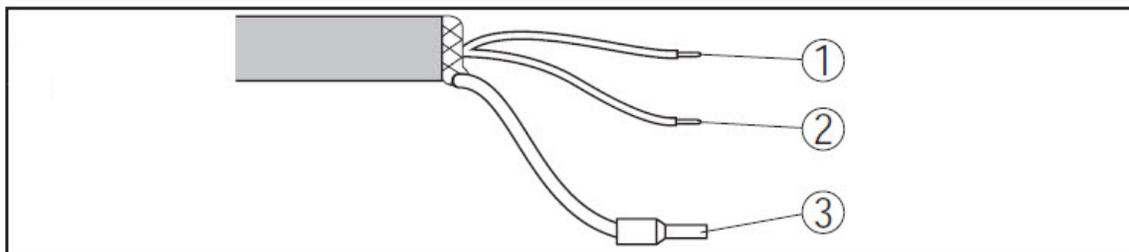


Fig. 12: Wire assignment in permanently connected connection cable

	Wire color	Function	Polarity
1	Brown	Voltage supply, signal output	Plus (+)
2	Blue	Voltage supply, signal output	Minus (-)
3		Shielding	

## 6 Setup with smartphone/tablet (Bluetooth)

### 6.1 Preparations

Make sure that your smartphone/tablet meets the following system requirements:

- Operating system: iOS 8 or newer
- Operating system: Android 5.1 or newer
- Bluetooth 4.0 LE or newer

Download the Wireless Device Configurator app from the “*Apple App Store*” or “*Google Play Store*” to your smartphone or tablet. To enable the Bluetooth software enter the BinMaster company ID code **BMQXZ**.

### 6.2 Connecting

Start the adjustment app and select the function “Setup”. The smartphone/tablet searches automatically for Bluetooth-capable instruments in the area.

The message “*Connecting ...*” is displayed.

The devices found are listed and the search is automatically continued.

Select the requested instrument in the device list.

When establishing the connection for the first time, the operating tool and the sensor must authenticate each other. After the first correct authentication, each subsequent connection is made without a new authentication query.

For authentication, enter the 6-digit Bluetooth access code in the next menu window. You can find the code on the outside of the device housing.

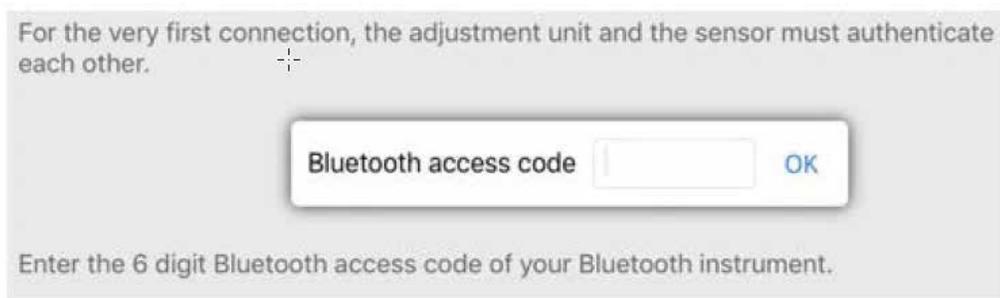


Fig. 13: Enter Bluetooth access code

**Note:**

**i** If an incorrect code is entered, the code can only be entered again after a time delay and the delay gets longer after each incorrect entry. The message “*Waiting for authentication*” is displayed on the smartphone/tablet.

After the sensor is connected, the sensor adjustment menu is displayed on the smartphone/tablet.

If the Bluetooth connection is interrupted, e.g. due to a too large distance between the two devices, this is displayed on the smartphone/tablet. The message disappears when the connection is restored.

Parameter adjustment of the device is only possible if the parameter protection is deactivated, which is default. Parameter protection can be activated later if desired.

## 6.3 Parameter adjustment

The sensor adjustment menu is divided into two areas, which are arranged next to each other or one below the other, depending on the adjustment tool.

- Navigation section
- Menu item display

The selected menu item can be recognized by the color change.

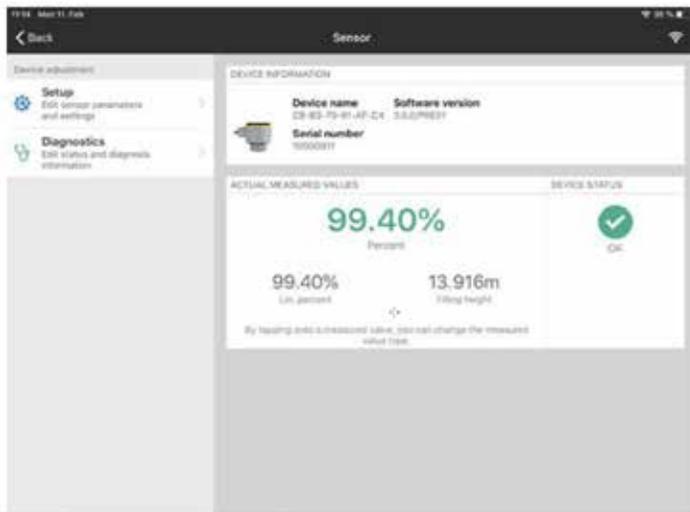


Fig. 14: Example of an app view - Setup sensor adjustment

Enter the requested parameters and confirm via the keyboard or the editing field. The settings are then active in the sensor.

Close the app to terminate connection.

**Note:**

**i** If the CNCR fails to connect to the Wireless Device Configuration App (WDCA) via Bluetooth, close the (WDCA), power cycle the CNCR and attempt to reconnect.

If further action is required, power cycle the Bluetooth on your device, and repeat the steps above.

## 7 Menu overview

Menu item	Selection	Default settings
Measurement loop name	Alphanumeric characters	Sensor
Application liquid	Storage tank, agitator tank, dosing tank, pumping station/pump shaft, rain overflow basin, tank/collection basin, plastic tank (measurement through tank top), mobile plastic tank (IBC), level measurement in waters, flow measurement flume/overflow, demonstration	Storage tank
Application bulk solid	Silo (slim and high), bunker (large volume), stockpile (point measurement/profile detection), crusher, demonstration	Silo (slender and high)
Units	Distance unit of the device Temperature unit of the instrument	Distance in ft. Temperature in °F
Adjustment	<b>Max. adjustment (distance A) - 20mA (100%)</b> <b>Min. adjustment (distance B) - 4mA (0%)</b>	<b>Distance from sensor</b> <b>Max. adjustment 0.0 m</b> <b>Min. adjustment 8.0 m</b>

### Extended Functions

Menu item	Selection	Basic settings
Damping	Integration time	0 s
Current output	Output characteristics	4 to 20-mA = 0% to 100%
	Current range	Min. current 3.8 mA and max. current 20.5 mA
	Reaction when malfunctions occur	Failure mode < 3.6 mA
<b>Linearization</b>	<b>Linearization type</b>	<b>Linear</b>
Scaling	Scaling size Scaling unit Scaling format	0 % correspond to 0 l 100 % correspond to 100 l
Display	Menu language Displayed value Backlight	English - Distance On
Access protection	Bluetooth access code	-
	Parameter protection	Deactivated
False signal suppression	False signal suppression	0 m
	Sounded distance to the medium	0 m
HART variables	First HART value (PV) Second HART value (SV) Third HART value (TV) Fourth HART value (QV) Long TAG Message	Lin. percent Distance Measurement reliability Electronics temperature
Reset	Delivery status, basic settings	-
Status signals	Function check Maintenance required Out of specification	On Off Off

## Diagnostics

Menu item	Selection	Basic settings
Status	Sensor status Measured value status Status output HART Device Status Status additional measured value	-
Echo curve	Indication of echo curve	-

# 8 Diagnostics and servicing

## 8.1 Maintenance

If the device is used properly, no special maintenance is required in normal operation.

In some applications, buildup on the antenna system can influence the measurement. Depending on the sensor and application, be careful to avoid heavy soiling of the antenna system. If necessary, clean the antenna system periodically.

## 8.2 Status messages

The status messages are divided into the following categories:

- Failure
- Function check
- Out of specification
- Maintenance required

### Failure

Code Text message	Cause	Rectification	DevSpec State in CMD 48
F013 No measured value available	No measured value in the boot up phase or during operation	Check or correct installation and/or parameter settings Clean the antenna system	Byte 5, Bit 0 of Byte 0 to 5
F017 Adjustment span too small	Adjustment not within specification	Change adjustment according to the limit values (difference between min. and max. $\geq 10$ mm)	Byte 5, Bit 1 of Byte 0 to 5
F025 Error in the Linearization table	Linearization values are not continuously rising, for example illogical value pairs	Check Linearization table Delete table/Create new	Byte 5, Bit 2 of Byte 0 to 5
F036 No operable software	Checksum error if software update failed or aborted	Repeat software update Send instrument in for repair	Byte 5, Bit 3 of Byte 0 to 5
F040 Error in the electronics	Limit value exceeded in signal processing Hardware error	Restart instrument Send instrument in for repair	Byte 5, Byte 5, Bit 4 of Byte 0 to 5
F080 General software error	General software error	Restart instrument	Byte 5, Byte 5, Bit 5 of Byte 0 to 5

## Failure

Code Text message	Cause	Rectification	
F105 Determine measured value	The instrument is still in the boot up phase, the measured value could not yet be determined	Wait for the end of the boot up phase Duration up to 3 minutes depending on the measurement environment and parameter settings	Byte 5, Bit 5, Bit 6 of Byte 0 to 5
F260 Error in the calibration	Checksum error in the calibration values Error in the EEPROM	Send instrument in for repair	Byte 4, Bit 0 of Byte 0 to 5
F261 Error in the instrument settings	Error during setup False signal suppression faulty Error when carrying out a reset	Repeat setup Reset instrument	Byte 4, Bit 1 of Byte 0 to 5
F265 Measurement function disturbed	Program sequence of the measuring function disturbed	Device restarts automatically	Byte 4, Bit 3 of Byte 0 to 5

## Function check

Code Text message	Cause	Rectification	DevSpec State in CMD 48
C700 Simulation active	A simulation is active	Finish simulation Wait for the automatic end after 60 min.	“Simulation Active” in “Standardized Status 0”

## Out of specification

Code Text message	Cause	Rectification	DevSpec State in CMD 48
S600 Impermissible electronics temperature	Temperature of the electronics out of specified range	Check ambient temperature Insulate electronics	Byte 23, Bit 4 of Byte 14 to 24
S601 Overfilling	Danger of vessel overfilling	Make sure that there is no further filling Check level in the vessel	Byte 23, Bit 5 of Byte 14 to 24
S603 Impermissible operating voltage	Terminal voltage too low	Check terminal voltage, increase operating voltage	Byte 23, Bit 6 of Byte 14 to 24

## Maintenance

Code Text message	Cause	Rectification	DevSpec State in CMD 48
M500 Error in the delivery status			Bit 0 of Byte 14 to 24
M501 Error in the delivery status			Bit 1 of Byte 14 to 24
M504 Error at a device interface	Hardware defect	Check connections Exchanging the electronics Send instrument for repair	Bit 4 of Byte 14 to 24
M505 No echo available	Sensor does not detect an echo during operation Antenna dirty or defective	Clean the antenna Use a more suitable antenna/sensor Remove possible false echoes Optimize sensor position and orientation	Bit 5 of Byte 14 to 24
M507 Error in the instrument settings	Error during setup Error when carrying out a reset False signal suppression faulty	Carry out reset and repeat setup	Bit 7 of Byte 14 to 24
M508 Data error in program memory Bluetooth controller			Bit 8 of Byte 14 to 24
M509 Software update			Bit 9 of Byte 14 to 24
M510 No communication with the sensor			Bit 10 of Byte 14 to 24

## 9 Removal

### 9.1 Disposal

The device is made of recyclable materials that can be disposed of by specialty recycling companies. Observe the applicable local regulations for proper disposal.

## 10 Certificates and approvals

### 10.1 Radio licenses

#### Radar

The device has been tested and approved in accordance with the current edition of the applicable country-specific norms or standards.

#### Bluetooth

The Bluetooth radio module in the device has been tested and approved according to the current edition of the applicable country-specific norms or standards.

# 11 Supplement

## 11.1 Technical data

### Note for approved instruments

The technical data in the respective safety instructions which are included are valid for approved instruments (e.g. with Ex approval). These data can differ from the data listed herein, for example regarding the process conditions or the voltage supply.

### Materials and weights

#### Materials, wetted parts

- Antenna PVDF
- Counter nut (depending on device version) PP

#### Materials, non-wetted parts

- Housing PVDF
- Cable entry seal NBR
- Connection cable PUR

#### Weight

- Instrument 0.7 kg (1.543 lbs)
  - Connection cable 0.1 kg/m
- Mounting connection Thread G1, R1, 1 NPT

### Torques

- Torque counter nut max. 7 Nm (5.163 lbf ft)

### Measurement Range

Measurement range The measurement range is the distance between the antenna face of the sensor and the product surface. The antenna face is also the reference plane for the measurement.

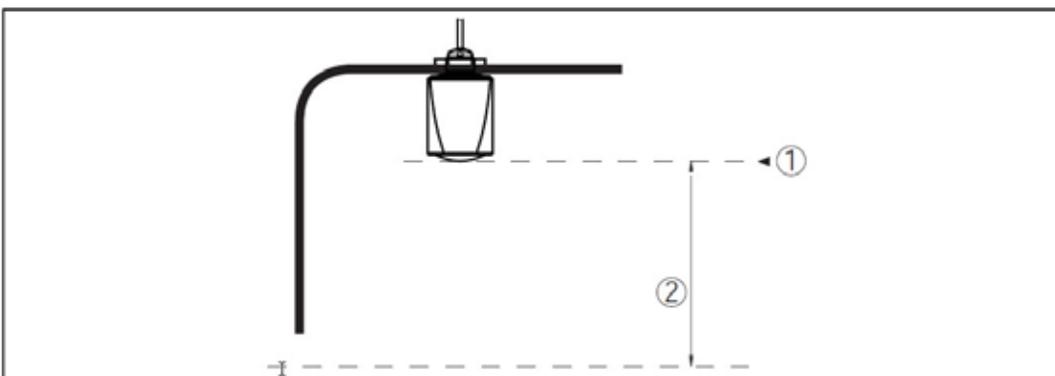


Fig. 15: Measurement Range

1. Reference plane

2. Measured variable, max. measuring range

Max. measuring range	30 m (98.43 ft)
Recommended measuring range	up to 20 m (65.62 ft)

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**Output**

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Output signal	4–20 mA/HART
Range of the output signal	3.8–20.5 mA/HART (default setting)
Signal resolution	0.3 $\mu$ A
Resolution, digital	1 mm (0.039 in)
Fault signal, current output (adjustable)	$\leq 3.6$ mA, $\geq 21$ mA, last valid measured value
Max. output current	22 mA
Starting current	$\leq 3.6$ mA; $\leq 10$ mA for 5 ms after switching on
Load	See load resistance under Power supply
Damping (63 % of the input variable), adjustable	0 to 999 s

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**Ambient conditions**

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Ambient temperature	-40 to +80 °C (-40 to +176 °F)
Storage and transport temperature	-40 to +80 °C (-40 to +176 °F)

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**Process conditions**

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For the process conditions, please also note the specifications on the type label. The lowest value (amount) always applies.

Process temperature	-40 to +80 °C (-40 to +176 °F)
Process pressure	-1 to 3 bar (-100 to 200 kPa/-14.5 to 43.51 psig)

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**Voltage supply**

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Operating voltage UB	
– at 4 mA	12 to 35 V DC
– at 20 mA	9 to 35 V DC
Reverse voltage protection	Integrated

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**Electrical protective measures**

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Protection rating	IP66/IP68 (3 bar) according to IEC 60529, Type 4P according to UL 50
Altitude above sea level	5000 m (16404 ft)
Protection class	III
Pollution degree	4

## 11.2 Dimensions

### CNCR-190

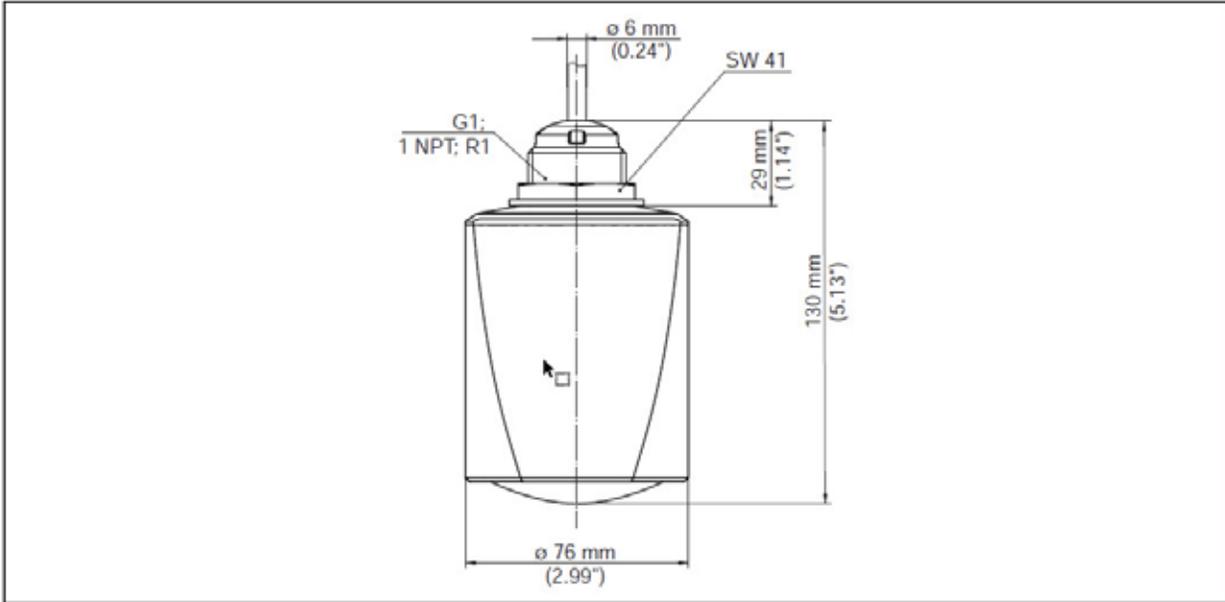


Fig. 16: Dimensions CNCR-190

All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.

Subject to change without prior notice.

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